

## **Elastomeric Seals: Types, Materials, Applications, Standards, and Troubleshooting**

Elastomeric seals are flexible components used to prevent fluid or gas leakage between mating surfaces. They are widely used in industries such as automotive, aerospace, oil & gas, and manufacturing due to their resilience, chemical resistance, and ability to withstand extreme temperatures and pressures.

### **Types of Elastomeric Seals**

#### **A. Static Seals (No relative motion between surfaces)**

Type	Description	Applications
O-Rings	Circular cross-section, sit in grooves	Hydraulic systems, pumps, valves
Gaskets	Flat seals between flanges	Pipe joints, engines, compressors
D-Rings	D-shaped cross-section	Low-pressure static sealing
Square Rings	Rectangular cross-section	High-pressure hydraulic systems

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## B. Dynamic Seals (Relative motion between surfaces)

Type	Description	Applications
Rotary Shaft Seals	Prevent leakage along rotating shafts	Pumps, motors, gearboxes
Reciprocating Seals	For linear motion systems	Hydraulic cylinders, pistons
Lip Seals	Flexible lip contacts moving part	Automotive wheel bearings, transmissions
U-Cups	U-shaped for pistons & rods	Hydraulic and pneumatic cylinders



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## Material Configurations & Properties

Material	Temperature Range	Chemical Resistance	Key Features	Common Applications
Nitrile (NBR)	-40°C to +120°C	Good for oils, fuels	Cost-effective, durable	Automotive fuel systems, hydraulic seals
Fluoroelastomer (FKM/Viton®)	-20°C to +200°C	Excellent for fuels, acids	High heat resistance	Aerospace, chemical processing
Silicone (VMQ)	-60°C to +230°C	Moderate chemical resistance	Flexible, biocompatible	Medical, food-grade applications
Ethylene Propylene (EPDM)	-50°C to +150°C	Resistant to water, steam	Weather-resistant	Outdoor seals, HVAC systems
Polyurethane (AU/EU)	-40°C to +80°C	Good abrasion resistance	High wear resistance	Hydraulic seals, industrial machinery
PTFE (Teflon®)	-200°C to +260°C	Exceptional chemical resistance	Low friction, non-stick	Chemical processing, high-purity seals

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## Technical Standards & Specifications

Standard	Description	Applicable Seals
AS568	Standard O-ring sizes (SAE)	O-Rings
ISO 3601	Metric O-ring dimensions	O-Rings
ASTM D2000	Rubber material classification	All elastomeric seals
MIL-STD-417	Military sealing standards	Aerospace & defense seals
DIN 3771	Metric O-ring groove standards	O-Rings
BS 4518	Hydraulic seal standards	U-Cups, Lip Seals

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## Standard Sizes & Dimensions (O-Rings as Example)

AS568 Size	Inner Diameter (mm)	Cross-Section (mm)	Common Applications
001	1.78	1.78	Small pneumatic systems
010	6.07	1.78	Hydraulic fittings
112	19.63	2.62	Automotive fuel systems
320	74.63	3.53	Industrial pumps
430	139.73	5.33	Large hydraulic cylinders

## Troubleshooting Common Seal Failures

Issue	Possible Cause	Solution
Extrusion	High pressure, incorrect hardness	Use harder material (e.g., 90 Shore A)
Swelling	Chemical incompatibility	Switch to FKM or PTFE
Cracking	Ozone/UV exposure	Use EPDM or ozone-resistant material
Abrasion	Rough surfaces, misalignment	Polish mating surfaces, use polyurethane
Compression Set	Over-compression, high temperature	Use high-temperature material (FKM)

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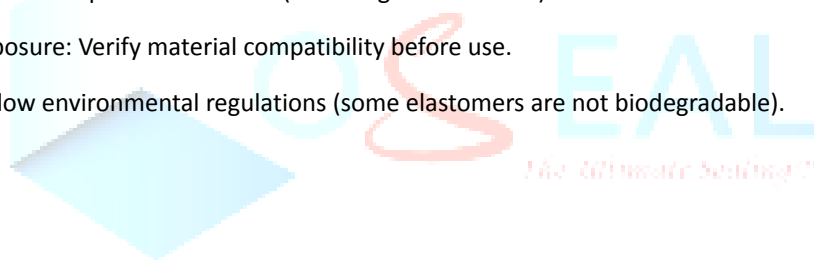
## How to Order Elastomeric Seals

When ordering, specify:

- Seal Type (O-Ring, Gasket, U-Cup, etc.)
- Material (NBR, FKM, EPDM, etc.)
- Size (AS568, ISO 3601, or custom dimensions)
- Hardness (Shore A scale, e.g., 70A, 90A)
- Standards (MIL, ASTM, DIN, etc.)
- Special Requirements (FDA-approved, conductive, etc.)

## Safety & Handling Guidelines

- Storage: Keep in cool, dark place away from UV/ozone exposure.
- Installation: Avoid twisting or over-stretching seals.
- Lubrication: Use compatible lubricants (silicone grease for NBR).
- Chemical Exposure: Verify material compatibility before use.
- Disposal: Follow environmental regulations (some elastomers are not biodegradable).



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